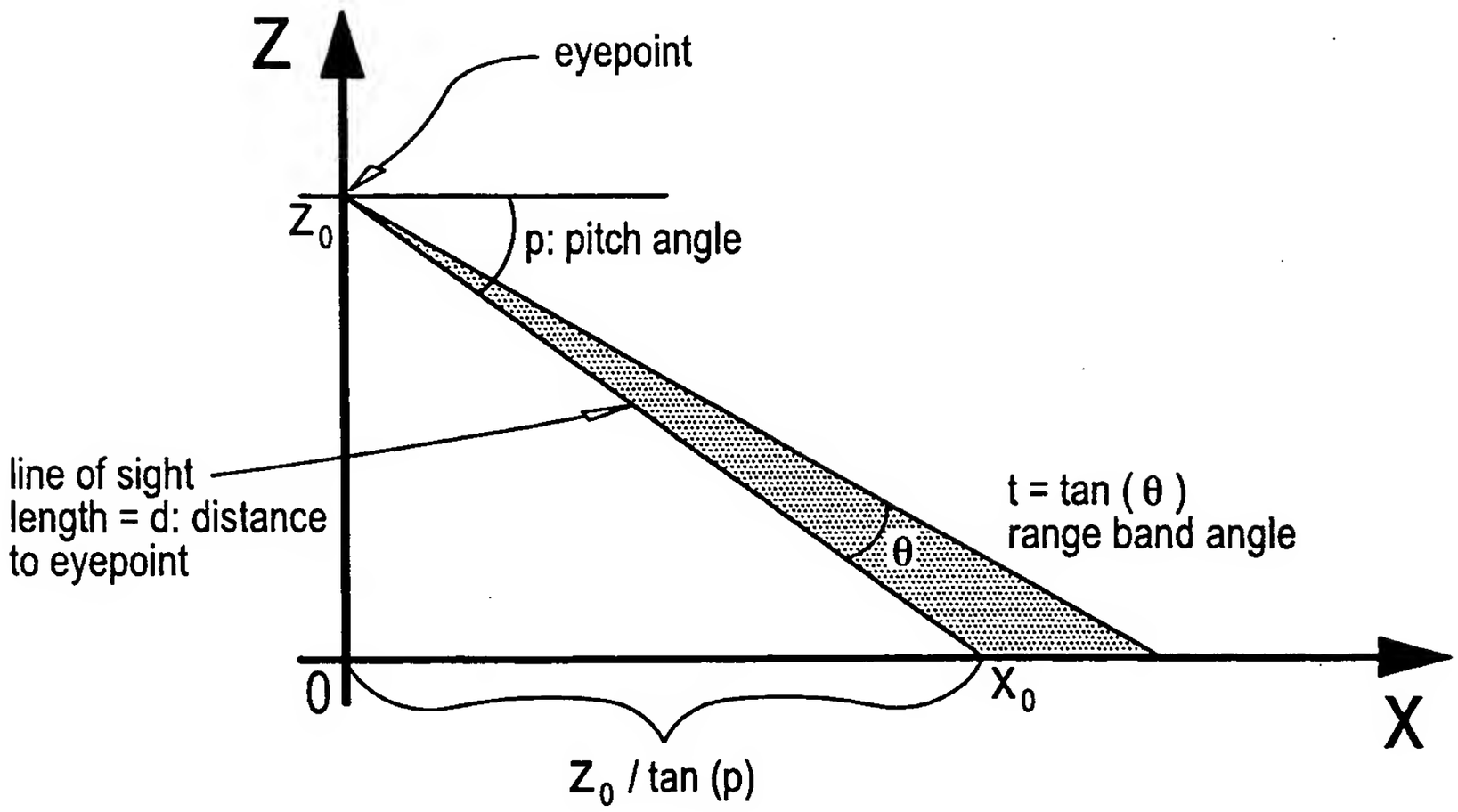
Z
eyepoint
Z_0
p: pitch angle
line of sight
length = d: distance
to eyepoint
t = tan (θ)
range band angle
θ
0
X_0
X
Z_0 / tan (p)

FIG. 1A

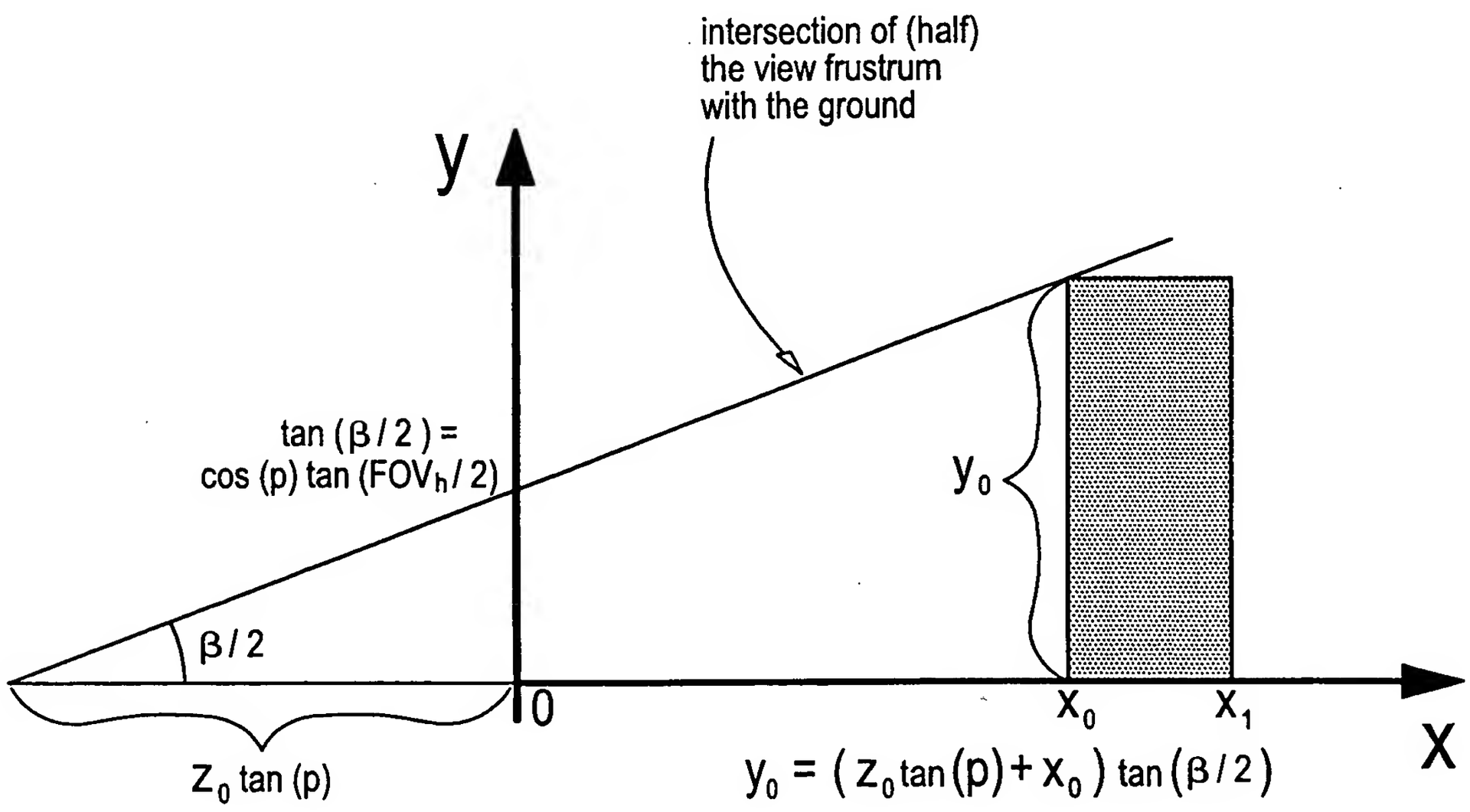
intersection of (half)
the view frustrum
with the ground
y
tan (β / 2) =
cos (p) tan (FOV_h / 2)
y_0
β / 2
0
X_0
X_1
X
Z_0 tan (p)
$y_0 = (Z_0 \tan(p) + X_0) \tan(\beta/2)$

FIG. 1B

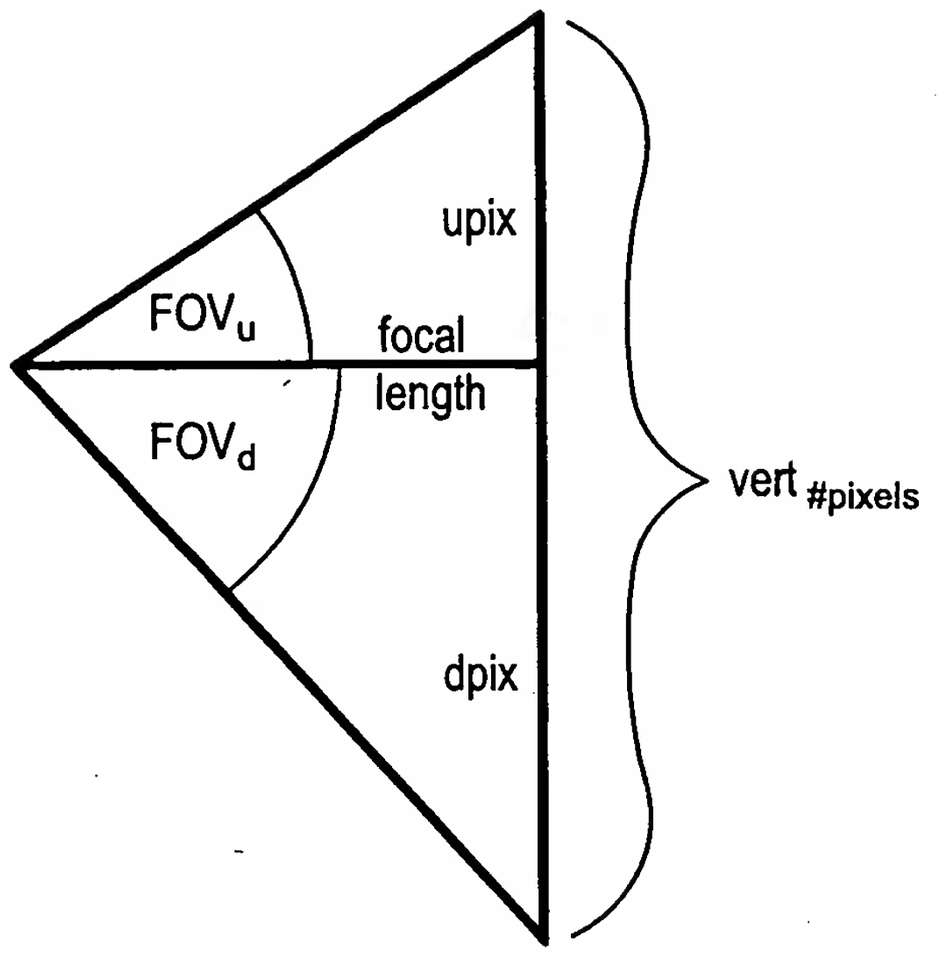
upix
FOV_u
focal
length
FOV_d
vert #pixels
dpix

FIG. 2

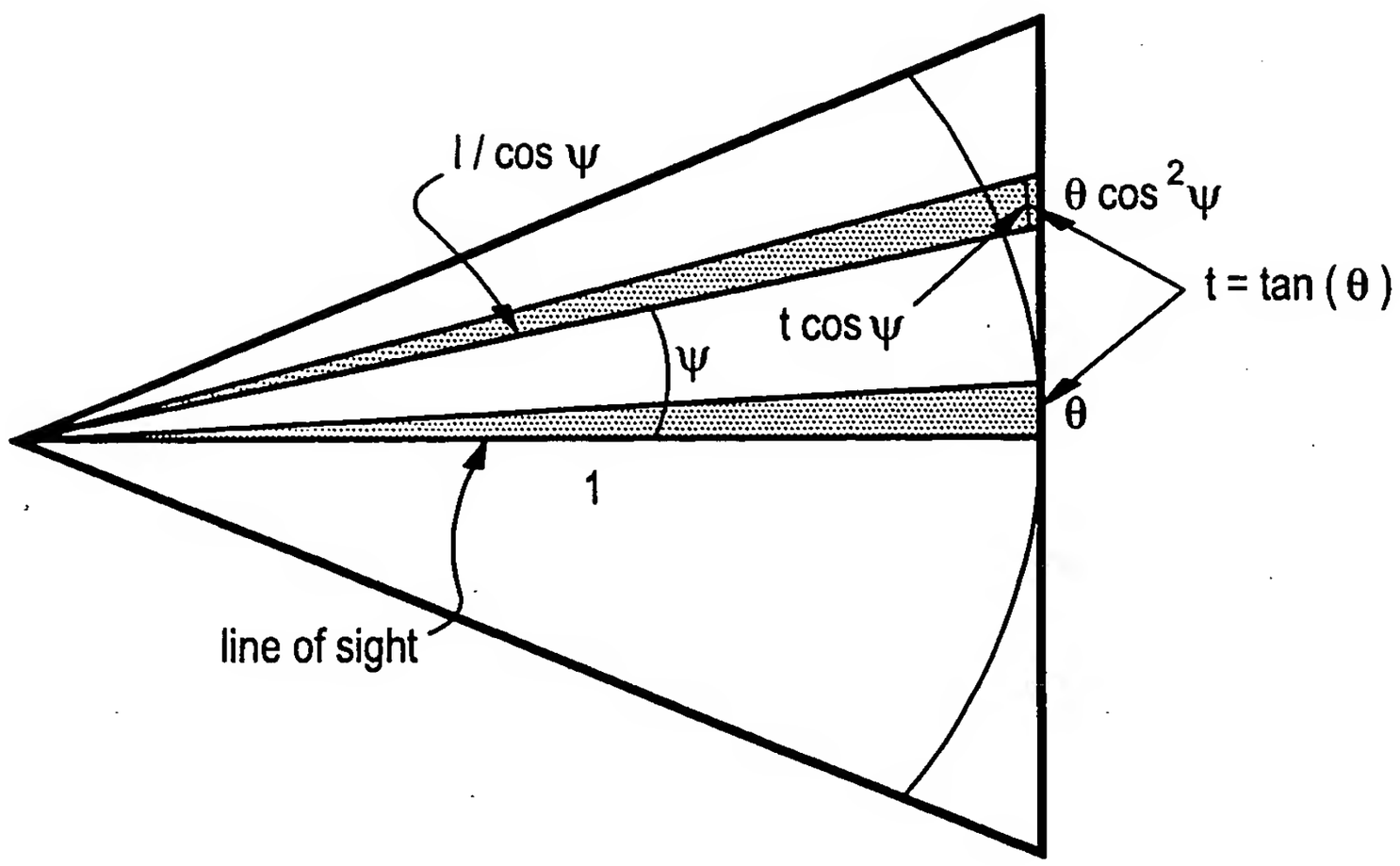
l / cos ψ
θ cos 2ψ
t = tan (θ)
t cos ψ
ψ
θ
1
line of sight

FIG. 3

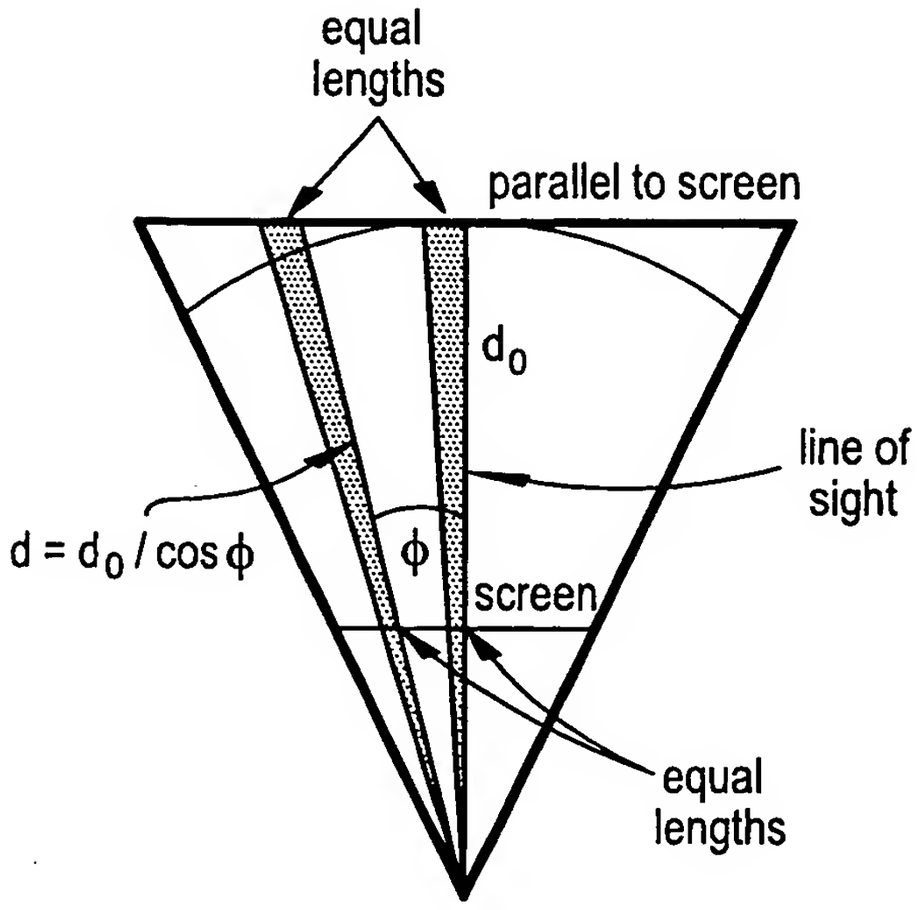
equal
lengths
parallel to screen
d_0
line of
sight
$d = d_0 / \cos\phi$
ϕ
screen
equal
lengths

FIG. 4

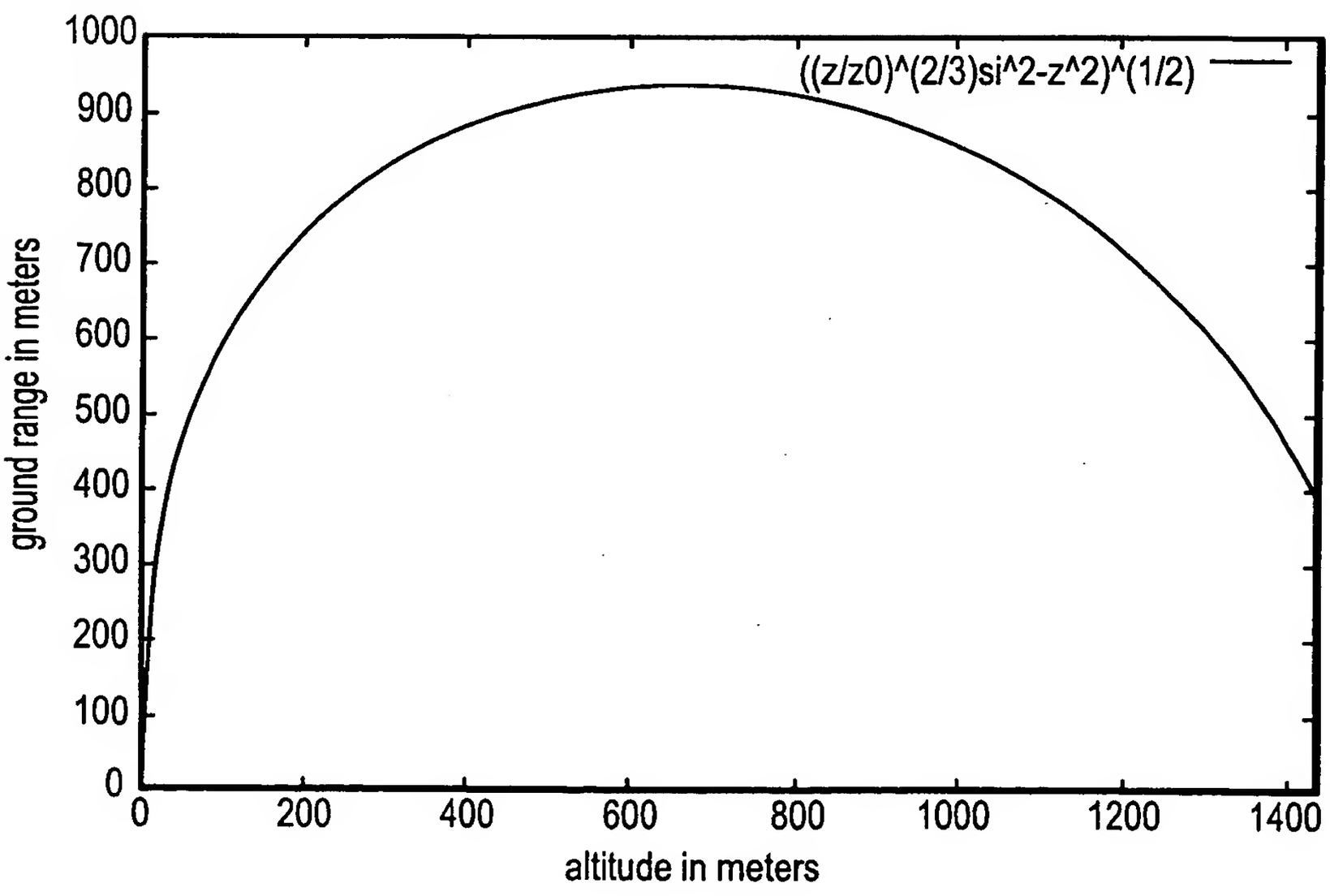
((z/z0)^(2/3)si^2-z^2)^(1/2)
1000
900
800
700
600
500
400
300
200
100
0
ground range in meters
0
200
400
600
800
1000
1200
1400
altitude in meters

FIG. 5

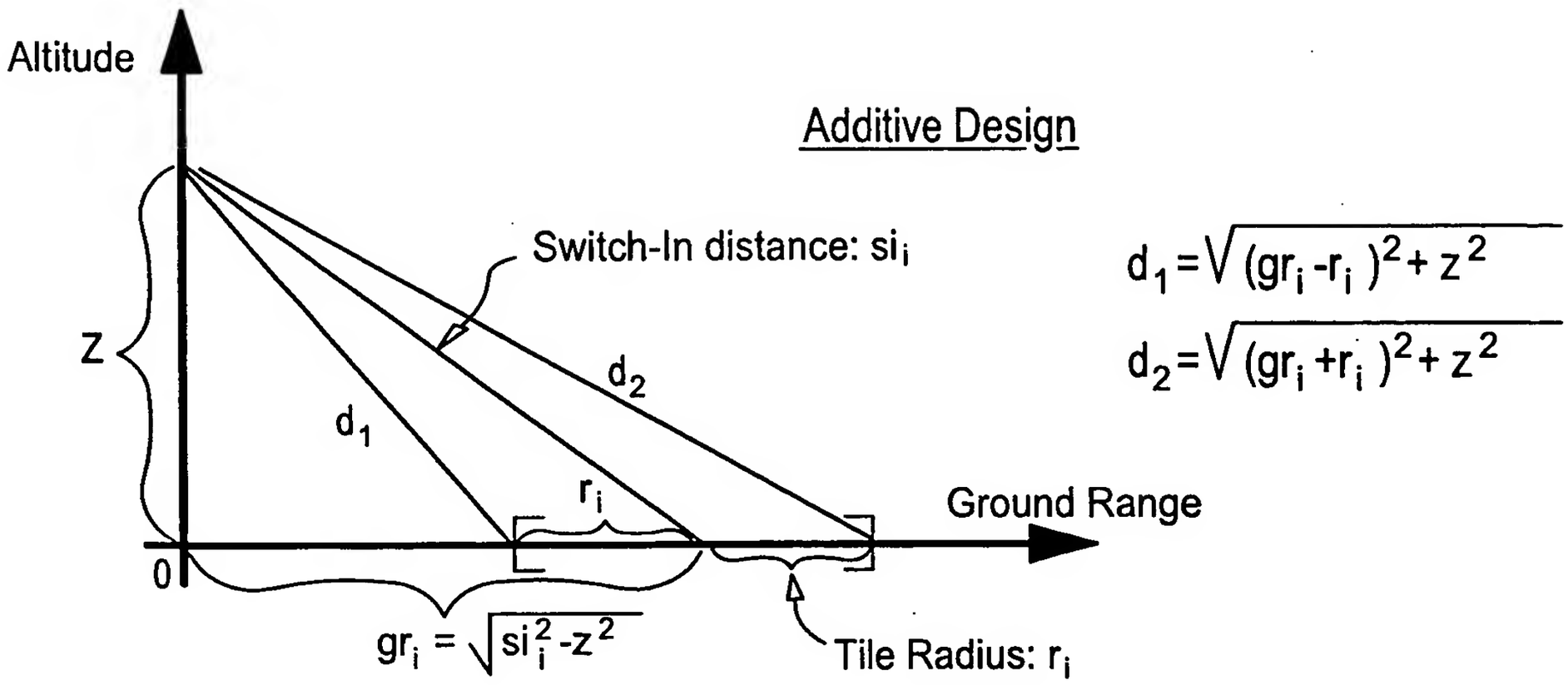
Altitude
Additive Design
Switch-In distance: si_i
$d_1 = \sqrt{(gr_i - r_i)^2 + z^2}$
$d_2 = \sqrt{(gr_i + r_i)^2 + z^2}$
Z
d_2
d_1
r_i
Ground Range
0
$gr_i = \sqrt{si_i^2 - z^2}$
Tile Radius: r_i

FIG. 6A

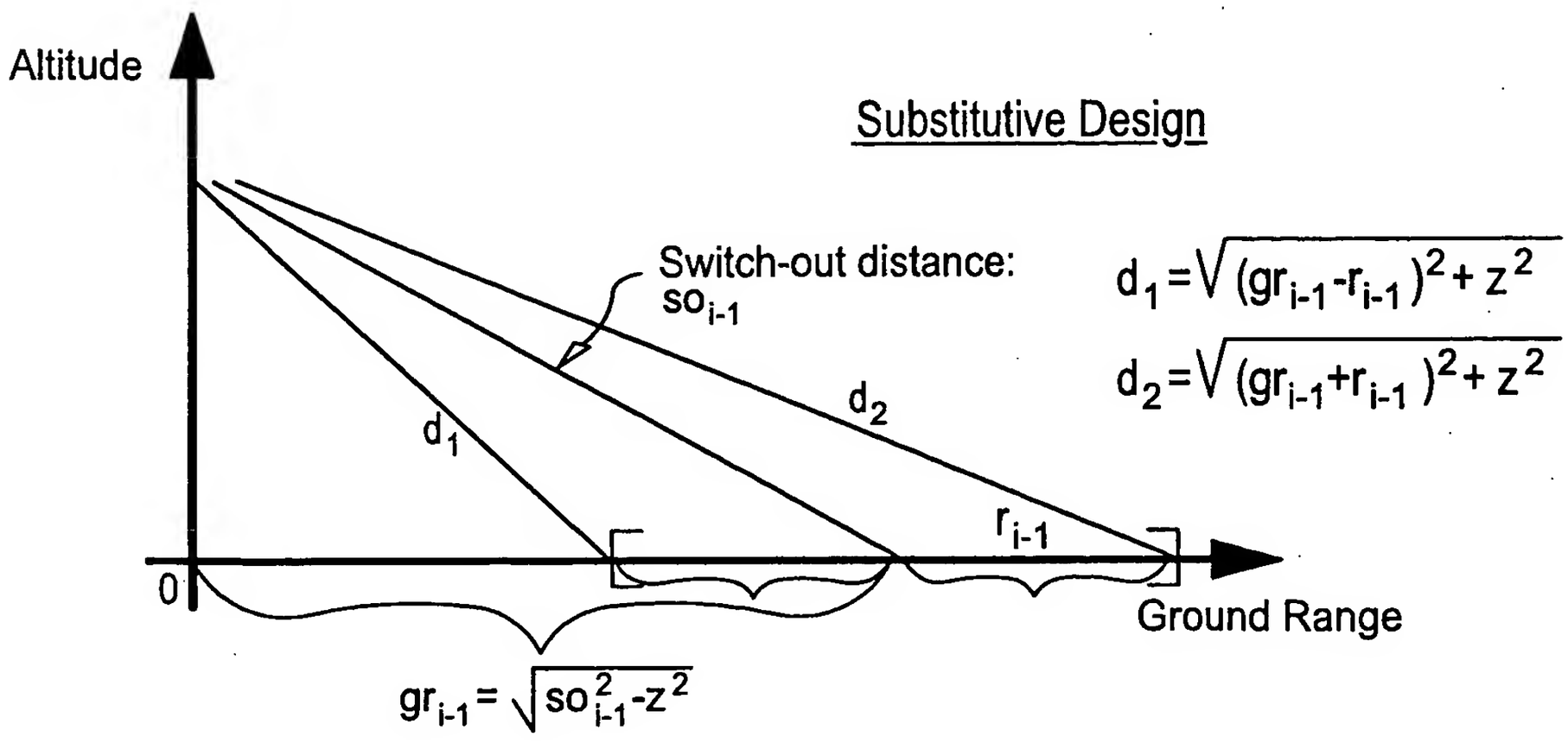
Altitude
Substitutive Design
Switch-out distance: so_{i-1}
$d_1 = \sqrt{(gr_{i-1} - r_{i-1})^2 + z^2}$
$d_2 = \sqrt{(gr_{i-1} + r_{i-1})^2 + z^2}$
d_2
d_1
r_{i-1}
0
Ground Range
$gr_{i-1} = \sqrt{so_{i-1}^2 - z^2}$

FIG. 6B

FIG. 7

FIG. 7A

FIG. 7B

Channel and View Information

depth of view:	166,770	m			
total horizontal Field of view:	73.3	deg	hfov:	1.28	radians
up field of view:	30.63	deg	ufov:	0.53	radians
down field of view:	-33.14	deg	dfov:	-0.58	radians
total vertical field of view:	63.77	deg	vfov:	1.11	radians
channel height:	1,200	pixels	focal length:	964.5	pixels
channel width:	1,600	pixels			
maxAlt	15,000	m			

Tiling Scheme Definition

coverage size x:	111120	m
y:	111120	m
num quadtree tiles in coverage x:	2	
y:	2	
number of quadtree levels:	8	2 to 8
Tiles in Range Band of Highest LOD	2	suggest: 1.5 to 3.5
Polygons per tile Fall-off ratio	1.1	suggest: 1.0 to 1.2
hierarchy type:	1	Additive Hierarchy
smallest tile size x:	434.0625	m
y:	434.0625	m

Design Parameters

minimum size of objects in a tile:	1.0	pixels
maximum size of objects in a tile:	6	pixels
polygon budget	3,000	

Setup for QuadTree Simulation

			eyepoint location	
			Recommended	Used
altitude:	2,500	m		
vertical line of sight:	31.4889	deg	55,560	55,560
worst case LOS=	31.4889		13,890	13,890
eyepoint location override x:		m	scaling formula = 1.2675	
y:		m		
LOD Scale:	1.2675			

Output parameters for FlightIG

design altitude for scaling:	1,227.7
clamp Scale:	0.9036
clamp altitude:	905.8

FIG. 7A

Tile Data

level #	grid divisions x & y		tile size x & y		tile radius	tile diameters in range band	static ground range
1	2	2	55,560	55,560	39,287	1.47	115,176
2	2	2	27,780	27,780	19,643	0.57	22,295
3	2	2	13,890	13,890	9,822	0.65	12,681
4	2	2	6,945	6,945	4,911	0.74	7,229
5	2	2	3,473	3,473	2,455	0.84	4,149
6	2	2	1,736	1,736	1,228	0.99	2,438
7	2	2	868	868	614	1.28	1,571
8	2	2	434	434	307	2.00	1,228

Run QuadTree Simulation

QuadTree Outputs	
LOD Nodes	248
Group Nodes	88
Visible tiles	68
Visible polys	3,774

Proprietary Information

Output (Summary)

Static Switch ranges (before scaling)		number of polys per tile	cumulative number of polys per km square	Object critical size range for each level	
in	out			min	max
333,540.00	51,604.58	7.24	0.00	172.91	793.05
51,604.58	29,320.79	25.96	0.04	143.46	167.88
29,320.79	16,659.54	30.90	0.20	79.98	103.72
16,659.54	9,465.65	42.12	1.07	44.51	63.10
9,465.65	5,378.21	57.41	5.83	24.51	37.94
5,378.21	3,055.80	78.24	31.78	11.74	22.60
3,055.80	1,736.25	106.64	173.28	5.04	13.36
1,736.25	-	98.73	697.31	2.16	7.85

Instructions / Intuitions

E3:E10 "Channel and View Information" is presumed to be fixed by the simulation specification

E13:E14 "Tilting Scheme Definition"
The coverage area is set to 111,120 by default to reflect a standard geocell.

E15:E16 The number of quadtree tiles in the coverage define the size of the vega regions.The result is in E26:F26.

N3:N4 The "minimum and maximum size of objects in a tile" parameter defines the acceptable size of the objects that can occur at each level of the hierarchy.

K27:L31 These numbers represent the output of a simulation. After any change of input data, the QuadTree Simulation button must be activated, otherwise these numbers are incorrect. They are based upon counting visible tiles in the Simulation, and do not represent what the actual Performer TM scene graph would provide.

Input / Output-TileDesign / Output-FeatureSizes / Output-QuadTree /

6/11

FIG. 7B

	A	B	C	D	F	G	H	I	J	
1					QuadTree Simulation Outputs					
1	Proprietary Information				LOD Nodes	444				
1					Group Nodes	288				
10	Static Switch ranges (before scaling)	Tile Level	Switch In Dist	Switch-Out Dist	Resulting Number of tiles of each size on FOV	Density (num polys/tile), computed for dall	Override density formula	Polygon count	Max. Altitude at which Tile is visible	
11	72,824	1	333,540	61,697	8	12.82		103	20,000	
12	45,515	2	61,697	38,561	4	23.78		95	20,000	
13	28,447	3	38,561	24,101	2	24.35		49	20,000	
14	17,779	4	24,101	15,063	8	24.94		200	20,000	
15	11,112	5	15,063	9,414	10	25.54		255	20,000	
16	6,945	6	9,414	5,884	16	26.15		418	20,000	
17	4,341	7	5884	3677	19	26.78		509	10,447	
18	-	8	3677	0	18	92.28		1,661	5,162	
19				Total Tiles	85		Total Polys	3,290		

Input | Output-TileDesign | Output-FeatureSizes | Output-QuadTree

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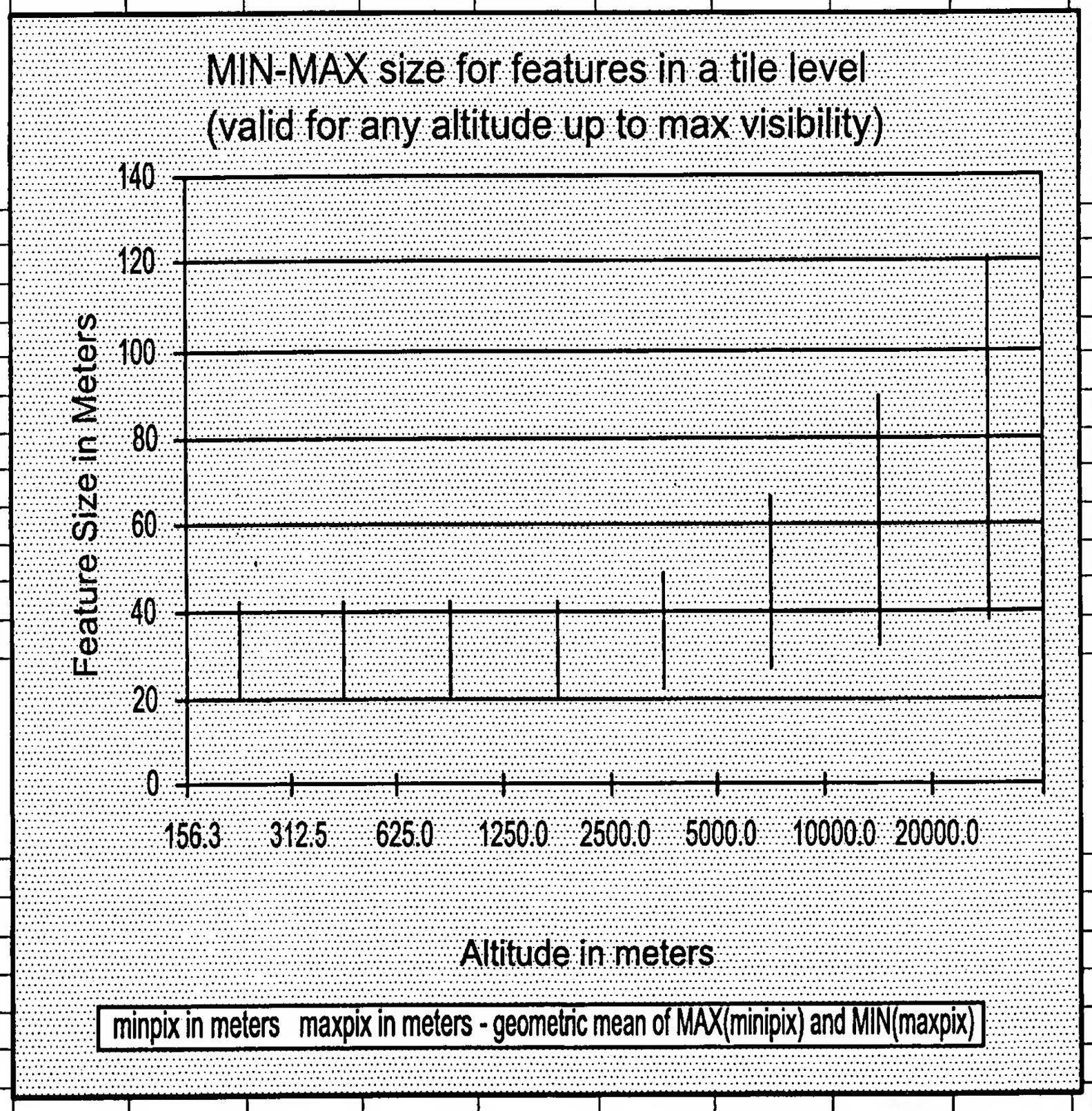
FIG. 8

	B	C	D	I	J
1					
2	Tile Level		6	between 2 and	8
3	Altitude	minpix in meters	maxpix in meters	geometric mean of MAX(minpix) and MIN(maxpix)	
4	156.25	20.70858	42.104044	40.3227123	
5	312.5	20.70796	42.108921	40.3227123	
6	625	20.70548	42.128434	40.3227123	
7	1250	20.69554	42.20652	40.3227123	
8	2500	22.26185	48.822598	40.3227123	
9	5000	26.66148	67.159201	40.3227123	
10	10000	32.09635	90.794853	40.3227123	
11	20000	38.61675	122.08015	40.3227123	
12					
13					
14					
15	Tile Level		1		
16	Altitude	minpix in meters	maxpix in meters	geometric mean of MAX(minpix) and MIN(maxpix)	
17	156.25	172.9077	691.63078	345.8153885	
18	312.5	172.9077	691.63078	345.8153885	
19	625	172.9077	691.63078	345.8153885	
20	1250	172.9077	691.63078	345.8153885	
21	2500	172.9077	691.63078	345.8153885	
22	5000	172.9077	691.63078	345.8153885	
23	10000	172.9077	691.63078	345.8153885	
24	20000	172.9077	691.63078	345.8153885	

(For Level-1 tiles see second table below row 18)



Input | Output-TileDesign | Output-FeatureSizes | Output-QuadTree

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FIG. 9

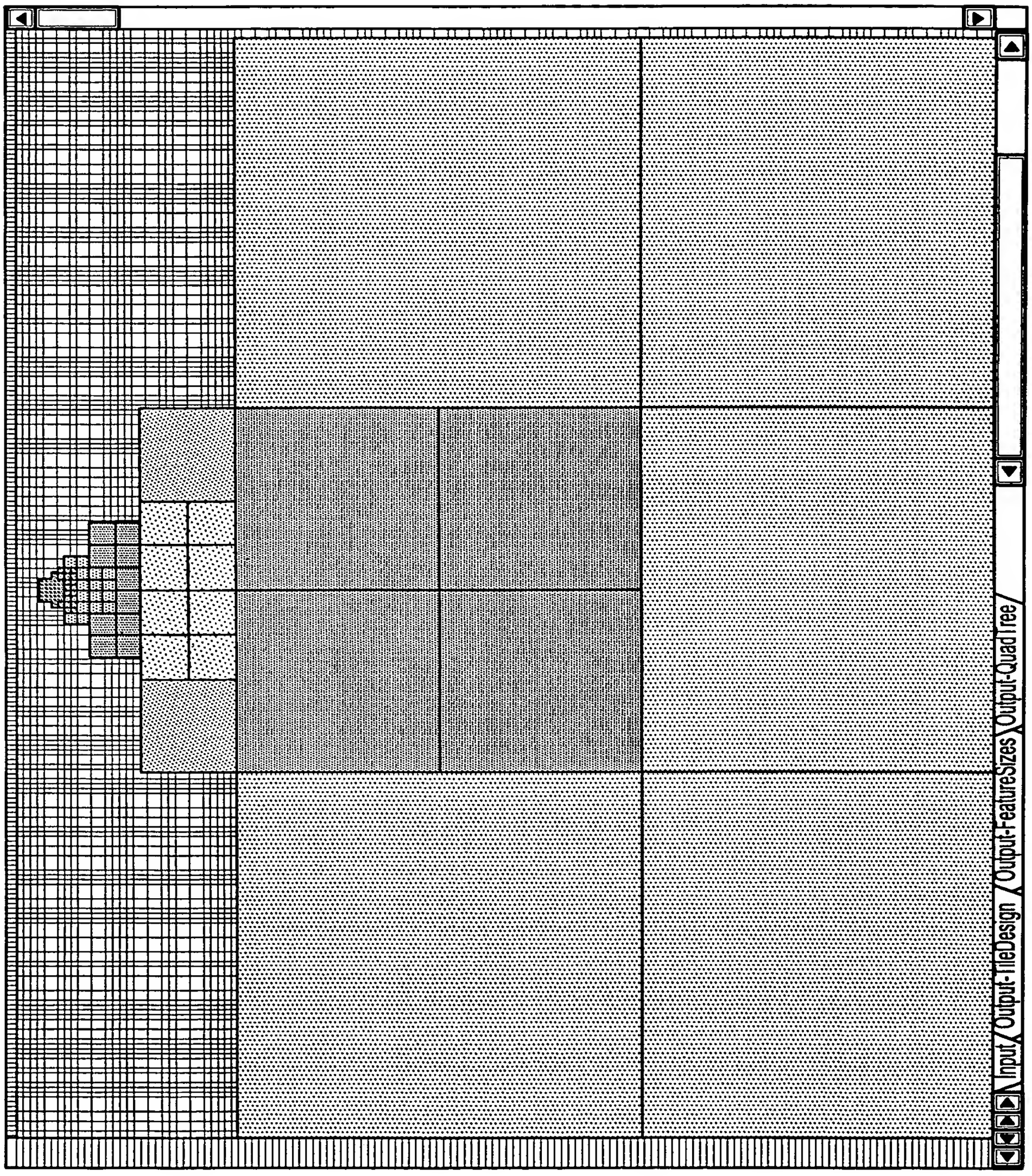
Input
Output-TileDesign
Output-FeatureSizes
Output-QuadTree

FIG. 10

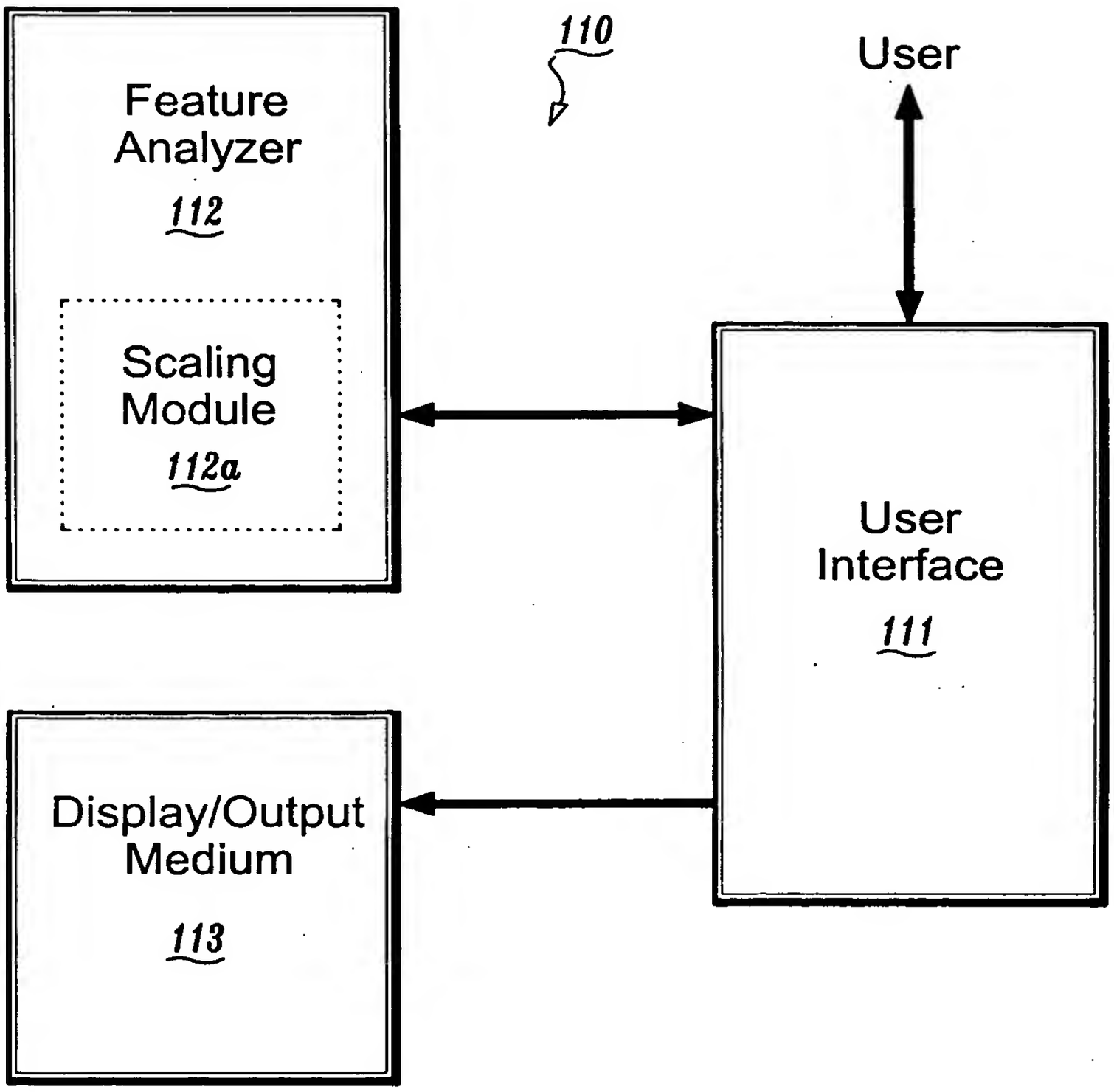
110
User
Feature Analyzer
112
Scaling Module
112a
User Interface
111
Display/Output Medium
113

FIG. 11

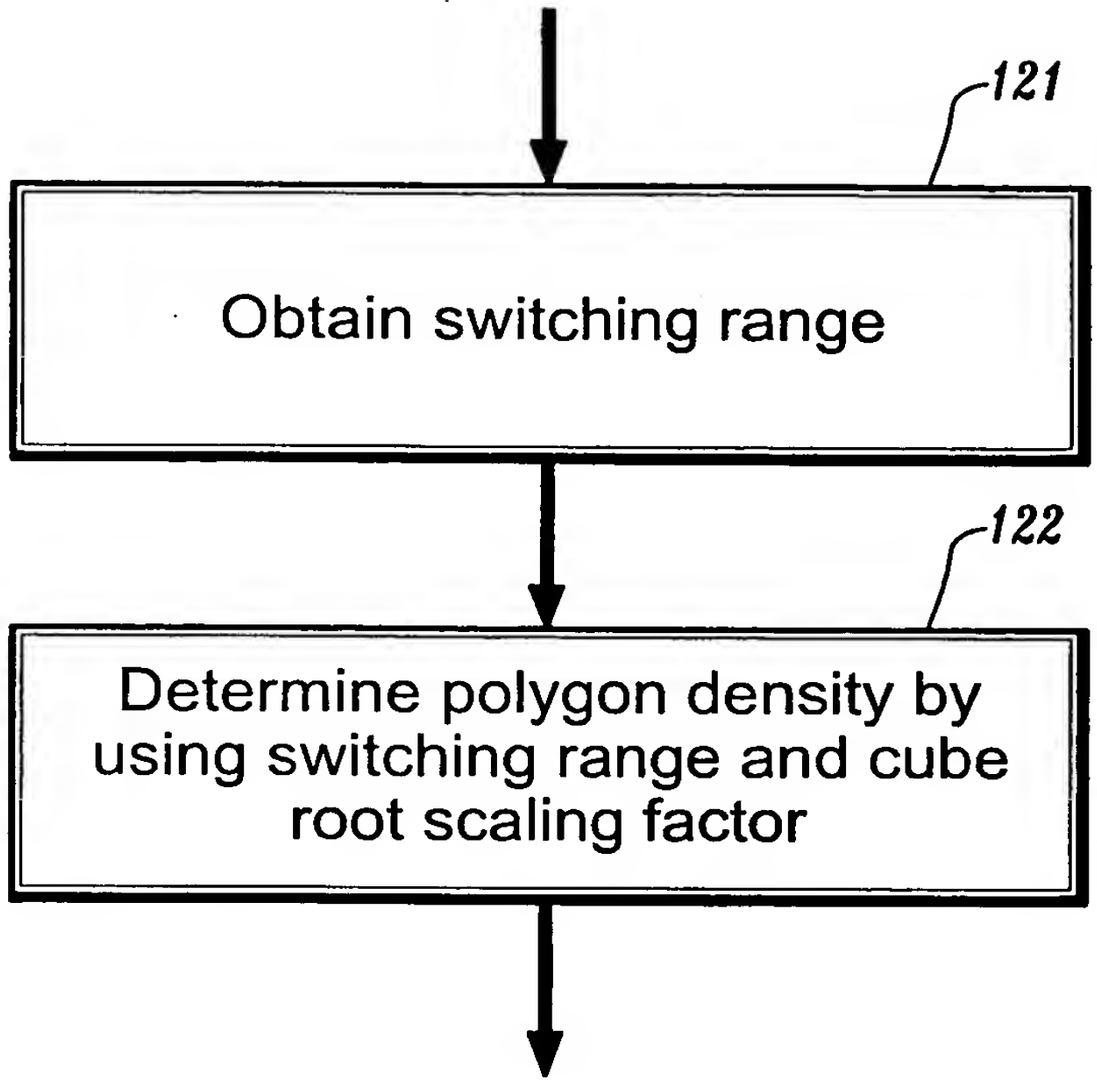
121
Obtain switching range
122
Determine polygon density by using switching range and cube root scaling factor

FIG. 12

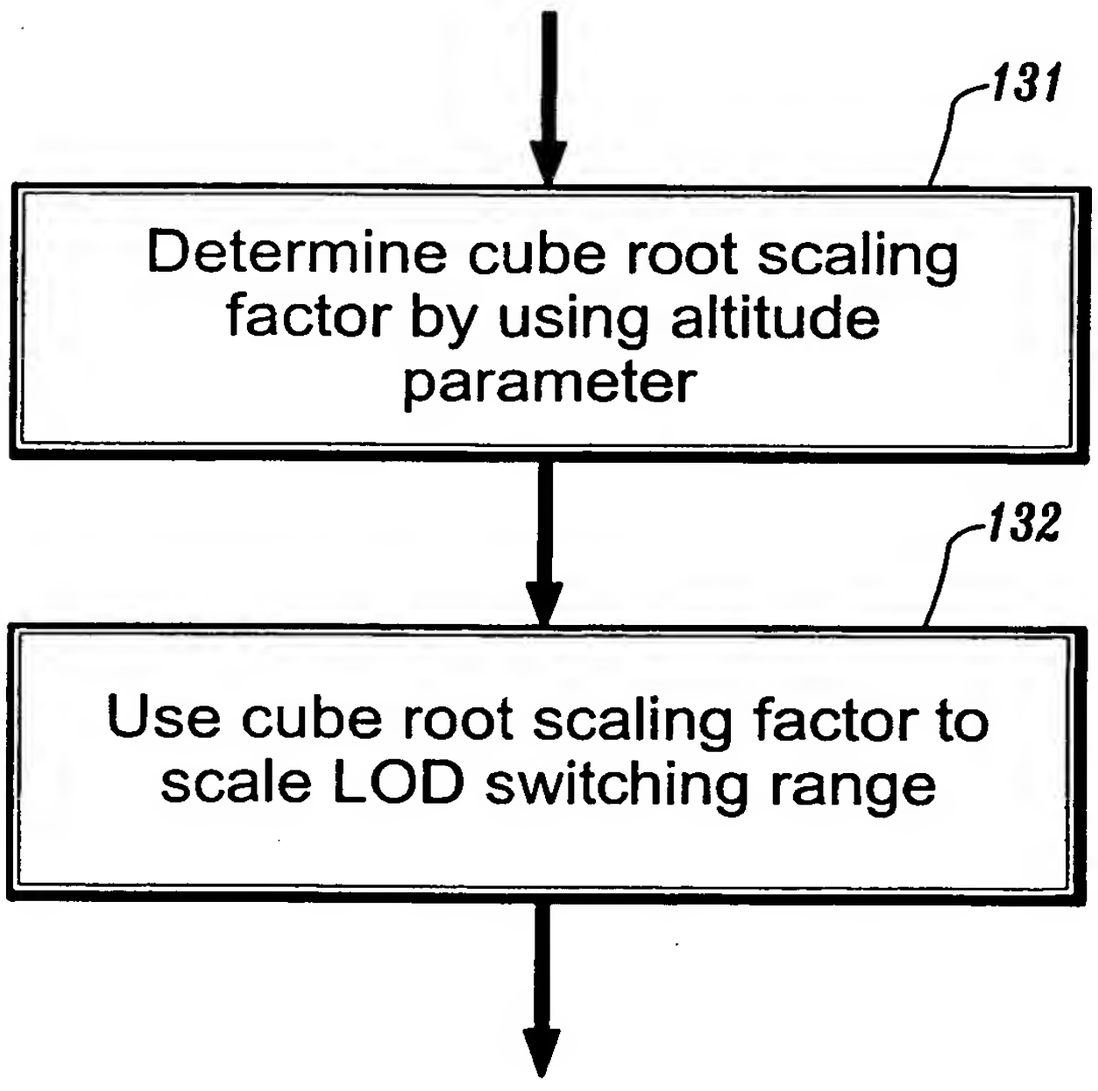
131
Determine cube root scaling factor by using altitude parameter
132
Use cube root scaling factor to scale LOD switching range

FIG. 13